Appendix 1— Proposed Sampling Plan

Scope and Application

For determination of the partial pressure of HAP constituents in samples of crude oil, and the HAP emission rate associated with a crude oil loading operation.

Summary of Method

HAP constituents in crude oil which may exert a non-negligible vapor pressure are n-Hexane, Benzene, Toluene, Xylenes, Ethylbenzene, 2,2,4-Trimethylpentane and Styrene. A detailed composition is obtained for the fraction C_1–C_9 in the crude oil sample.

The partial pressure of each HAP species is then estimated following Raoult's law, and total and speciated HAP emission rates are calculated.

Analytical procedures are those incorporated by reference in the Code of Federal Regulations.

Definitions

Target HAP constituent means n-Hexane, Benzene, Toluene, o-Xylene, m-Xylene, p-Xylene, Ethylbenzene, 2,2,4-Trimethylpentane, or Styrene.

Collection, Preservation, Storage and Transport procedures for Crude oil Sample

Collect the sample as specified in ASTM D4057 (40 CFR § 75.6(a)(33))

Light Ends Analysis

Follow the procedures for a light ends analysis specified in ASTM D7169 (Appendix 1), which incorporates ASTM D7900 (49 CFR § 171.7(h)(45)).

Liquid Phase Molecular Weight Determination

Determine the molecular weight of the crude oil sample (MW_c) as specified in ASTM D2502 (40 CFR § 98.74(c)(3)).

Data Reduction

Results of the light ends analysis are reported as the mass fraction of each target HAP constituent in the liquid phase (m_i) of the whole crude oil sample.

The mole fraction of each target HAP constituent (MW_i) is calculated as follows:

$$y_i = m_i \times (MW_c / MW_i)$$

The pure component vapor pressure of each target HAP constituent (p_i^*) is calculated using published Antoine Coefficients for the constituent. p_i is calculated for the average monthly temperature for Corpus Christi, TX for the month during which the sample is collected.

The partial pressure (p_i) of each target HAP constituent is calculated as follows:

$$p_i = y_i \times p_i^*$$

A HAP loading loss factor (L_L) corresponding to the loading event is calculated following Equation (1) of AP-42 Section 5.2 using the same temperature used to calculate p_i^*.

The emission rate (E_i) for each target HAP constituent corresponding to the loading event is calculated as follows:

$$E_i = L_L \times Q$$

Where Q is the quantity of crude oil loaded, expressed in units of thousands of gallons (Mgal).

The total HAP emission rate (E) is calculated as follows:

$$E = \sum_{i \in \text{Target HAP}} E_i$$